

REMARKS/ARGUMENTS

Claims 1-6, 10-20, 22-24 and 30 are pending in this application. By this amendment, claims 7-9 have been cancelled without prejudice or disclaimer, claims 1, 16, 17, 22, 25 and 30 have been amended and claims 31-34 have been added. Support for new claims 31-34 can be found in the original specification including the claims and the figures, for example, see Fig. 3 and the text related thereto. Reconsideration in view of the above amendments and final remarks is respectfully requested.

1. § 112 Claim Rejections

Claims 8 and 9 stand rejected under § 112, second paragraph, as indefinite. Claims 8 and 9 have been cancelled without prejudice or disclaimer, therefore the rejection is moot. Withdrawal of the rejection is respectfully requested.

The Office Action also rejects claim 30 under 35 U.S.C. § 112, first paragraph. Applicants respectfully submit that the above amendments obviate the grounds for the rejection. Withdrawal of the rejection is respectfully requested.

2. § 103 Claim Rejections

Claims 1-4, 15-16, 18, 22-23 and 25-30 stand rejected under § 103(a) as unpatentable over U.S. Patent No. 2,704,727 to *Pawlyk* ("*Pawlyk*") in view of U.S. Patent No. 6,270,839 to *Onoe* ("*Onoe*"). Additionally, the remaining claims have been rejected under combinations of *Pawlyk* and *Onoe* in further view of Applicants' submitted related art, *Hillman et al.* (U.S. Patent No. 5,451,258, hereinafter referred to as "*Hillman*"), *Tsukada et al.* (U.S. Patent No. 6,319,327, hereinafter referred to as

"Tsukada"), *Lei* (U.S. Patent Application Publication No. 2003/0053799), *Jurgensen* (WO 02/27064), *Sandhu* (U.S. Patent Application Publication No. 2003/0072875); *Sugioka* (U.S. Patent No. 4,516,527), *Bailey et al.* (U.S. Patent No. 5,076,206, hereinafter referred to as "*Bailey*"), *Hiai et al.* (U.S. Patent No. 5,019,423, hereinafter referred to as "*Hiai*"), *Visser* (U.S. Patent No. 5,322,710), *Sielaff et al.* (U.S. Patent No. 4,861,524, hereinafter referred to as "*Sielaff*") and *Antell* (GB 2,223,509). The rejections are respectfully traversed.

Claim 1 recites a gas supplying apparatus for atomic layer deposition, which generates a source gas by vaporizing a powder source and supplies the source gas into a reaction chamber of an atomic layer deposition apparatus. The apparatus comprises a container including an upper portion, a middle portion and a lower portion, wherein the powder source is located in the lower portion of the container; a cover, which is installed in the upper portion of the container and covers the container; a gas inlet tube, which supplies a carrier gas into the middle portion of the container and includes a preheating portion wound on an outer circumference of the container and a connection portion for connecting the preheating portion and a carrier gas storage tank; a gas outlet tube, which exhausts the source gas generated in the container together with the carrier gas; a heating unit, heating the container and the preheating portion of the gas inlet tube together; a temperature sensor, which detects temperature in the container; and a temperature controller, which controls a power supply of the heating unit depending on a value of temperature detected by the temperature sensor, wherein a plurality of guide plates formed of a plurality of layers are formed in the container, so as to elongate a gas exhaust path,

and wherein the outlet of the gas inlet tube is horizontally installed in the middle portion of the container.

A. *Pawlyk* and *Onoe* References

Pawlyk discloses a method of deposition of non-conductive copper coatings from vapor phase, which includes a carburetor 4 with vertically arranged layers 13 of chromium carbonyl, supported on screens 15, which are separated by layers of glass wool 14. The metal screens 15 and 16 have powder particles thereon which vary from about 2 to 5 times the size of the screen openings. See col. 2, lines 64-71 and Fig. 2.

However, *Pawlyk* fails to disclose or suggest a container including an upper portion, a middle portion and a lower portion, wherein (1) the powder source is located in the lower portion of the container, (2) a gas inlet tube, which supplies carrier gas into the middle portion of the container, and (3) an outlet of the gas inlet tube horizontally installed in the middle portion of the container, as recited in claim 1. Rather, *Pawlyk* discloses (1) screens 15 (and thus powder particles) located throughout the carburetor 4, (2) an opening 5 located on a bottom portion of the carburetor 4, and the opening 5 vertically installed in a lower portion of the carburetor 4. See Fig. 2 and col. 2, lines 24-43.

Onoe fails to cure the deficiencies of *Pawlyk*. *Onoe* discloses, as illustrated in Fig. 4, a container 1 with subcontainers for storing raw materials 30a, 30b, 30c with a solid metal organic compound raw material 2 and a carrier gas inlet conduit 4.

However, *Onoe* fails to disclose or suggest, as discussed above with respect to *Pawlyk*, fails to disclose or suggest the combination of features of claim 1, including at least the features of a container including an upper portion, a middle

portion and a lower portion, wherein (1) the powder source is located in the lower portion of the container, (2) a gas inlet tube, which supplies carrier gas into the middle portion of the container, and (3) an outlet of the gas inlet tube horizontally installed in the middle portion of the container, as recited in claim 1. Rather, *Onoe* discloses a container 1 with solid metal organic compound raw material 2 located within subcontainers 30a, 30b, 30c in a central or upper portion of the container 1, an inlet 4 located on a lower portion of a container 1, and an outlet of the inlet 4 located installed on a lower portion of the container 1. See Fig. 4.

Therefore, concerning claim 1, Applicants respectfully submit that claim 1 is allowable. Claims 2-4, 15, 16, 18, 22, 23 and 27-30 depend from claim 1, and are allowable for at least the same reasons. Withdrawal of the rejection of claims 1-4, 15, 16, 18, 22, 23 and 27-30 is respectfully requested.

Concerning claim 25, which is now presented in independent form, recites a gas supplying apparatus for atomic layer deposition, which comprises a container including an upper portion, a middle portion and a lower portion; a powder source located in the lower portion of the container; a cover, which is installed in an upper portion of the container and covers the container; a gas inlet tube, which supplies carrier gas into the container; a gas outlet tube, which exhausts the source gas generated in the container together with the carrier gas; a heating unit, which heats the container; a temperature sensor, which detects temperature in the container; and a temperature controller, which controls a power supply of the heating unit depending on a value of temperature detected by the temperature sensor, wherein a plurality of guide plates are formed in the container, wherein an outlet end of the gas inlet tube is installed such that the carrier gas is not injected toward the powder

source, and wherein the outlet end of the gas inlet tube is installed in the container above the powder source.

Pawlyk fails to disclose or suggest the combination of features of claim 25, including at least the features of (1) a powder source located in the lower portion of the container, (2) an outlet end of the gas inlet tube installed such that the carrier gas is not injected toward the powder source, and wherein (3) the outlet end of the gas inlet tube is installed in the container above the powder source. Rather, as mentioned above, inlet 5 of *Pawlyk* discloses screens 15 (and thus powder particles) located throughout the carburetor 4, an inlet 5 located on a bottom portion of the carburetor 4, and the inlet 5 being vertically installed in a lower portion of the carburetor 4 below the screens 15 (and thus the powder particles) and the inlet 5. See Fig. 2 and col. 2, lines 24-43.

Onoe fails to cure the deficiencies of *Pawlyk*. As mentioned above, *Onoe* fails to disclose or suggest the combination of features of claim 25, including at least the features of (1) a powder source located in the lower portion of the container, (2) an outlet end of the gas inlet tube installed such that the carrier gas is not injected toward the powder source, and wherein (3) the outlet end of the gas inlet tube is installed in the container above the powder source. Rather, *Onoe* discloses a container 1 with solid metal organic compound raw material 2 located within subcontainers 30a, 30b, 30c in a central or upper portion of the container 1, an inlet into a subcontainer 30a, 30b, 30c which injects carrier gas toward the solid metal organic compound raw material 2 (see flow of arrows in Figure 5), and the inlet 4 installed below the solid metal organic compound raw material 2. See Figs. 4 and 5.

For at least the reasons set forth above, Applicants respectfully submit that claim 25 is allowable. Claim 26 depends from claim 25 and is allowable for at least the same reasons, as well as its added features and the combination thereof.

Withdrawal of the rejection is respectfully requested.

B. Secondary References

The remaining cited references fail to cure the deficiencies of *Pawlyk* or *Onoe*.

1. *Hillman*

Concerning *Hillman*, *Hillman* discloses a gas delivery apparatus which utilizes a liquid reactant material 6, as illustrated in Fig. 1 and gases. See col. 9, lines 6-32. However, *Hillman* fails to cure the deficiencies of *Pawlyk* and *Onoe*, as discussed above, as *Hillman* does not even address powder sources. Therefore, *Hillman* fails to cure the deficiencies of *Pawlyk* and *Onoe*.

2. *Tsukada*

Similarly, *Tsukada* discloses a liquid raw material 4 in gas, but fails to cure the deficiencies of *Pawlyk* and *Onoe*, as *Tsukada* also does not address powder sources. Therefore, *Tsukada* fails to cure the deficiencies of *Pawlyk* and *Onoe*.

3. *Lei*

Concerning the *Lei* reference, *Lei* discloses a surface with solid precursor 6 and an inlet 4 for controllably vaporizing the solid precursor material therein. See Figure 1. However, *Lei* also fails to cure the deficiencies of disclose *Pawlyk* and *Onoe*, as mentioned above. For example, *Lei* discloses surfaces with solid precursor 6 located above inlet 4, and a vertically oriented inlet 4 located on the bottom of housing 2. See Figure 1. Therefore, *Lei* fails to cure the deficiencies of *Pawlyk* and *Onoe*.

4. *Jurgensen*

Concerning *Jurgensen*, *Jurgensen* discloses a method and a device for depositing organic layers which includes a gas inlet 10 and starting material 3 in a vessel 2. However, *Jurgensen* also fails to cure the deficiencies of disclose *Pawlyk* and *Onoe*, as mentioned above. For example, *Jurgensen* discloses starting material 3 above a gas inlet 10, and a vertically oriented gas inlet 10 located on the bottom of vessel 2. See Figure 2. Therefore, *Jurgensen* fails to cure the deficiencies of *Pawlyk* and *Onoe*.

5. *Sandhu*

Concerning *Sandhu*, *Sandhu* discloses systems and methods for delivering solid precursors in deposition processes. As illustrated in Fig. 1, a solid precursor material 112 is heated to form a vapor 114. However, one of ordinary skill in the art would not look to *Sandhu* for teachings to combine with *Pawlyk* and *Onoe*.

The heated tank 2 of *Pawlyk* could not be used to sublimate the solid precursor material of *Sandhu* because of the sublimation issues identified in *Sandhu*. For example, in *Sandhu*, the heating surface 108 and a temperature control 110 are utilized to vaporize the solid precursor material, which in combination with a flow monitor, allows for sufficient sublimation with the continuously changing rate of vaporization. See paragraphs [0027] to [0029]. However, the heater in *Pawlyk* provides uniform heating for powder particles on screens 15, 16, which do not have the same sublimation issues and thus would defeat the purpose of *Sandhu*. Thus, the heater of *Pawlyk* cannot be used with the system of *Sandhu*.

6. *Sugioka*

Concerning *Sugioka*, *Sugioka* discloses a photochemical vapor deposition apparatus which includes a photoreactive gas provided into a reaction space 5 and deposited on a substrate 4. See Fig. 1. However, *Sugioka* fails to cure the deficiencies of disclose *Pawlyk* and *Onoe*, as mentioned above. For example, *Sugioka* does not disclose or suggest a powder source, let alone the other features mentioned above that *Pawlyk* and *Onoe* fail to disclose or suggest. Therefore, *Sugioka* fails to cure the deficiencies of *Pawlyk* and *Onoe*.

7. *Bailey*

Concerning *Bailey*, *Bailey* discloses a vertical low pressure chemical vapor deposition reactor which includes a gas inlet 13a with a gas tube 13 including deposition gases therein. However, *Bailey* fails to cure the deficiencies of disclose *Pawlyk* and *Onoe*, as mentioned above. For example, *Bailey* does not disclose or suggest a powder source, let alone the other features mentioned above that *Pawlyk* and *Onoe* fail to disclose or suggest. Therefore, *Bailey* fails to cure the deficiencies of *Pawlyk* and *Onoe*.

8. *Hiai*

Concerning *Hiai*, *Hiai* discloses vessel 10 in which an organic metal compound 60 is housed wherein the vessel is constructed in such a manner that the carrier gas is substantially saturated with the organic metal compound while passing through the packed bed 60 and removed through the efferent tube 30 at the top of said vessel. However, *Hiai* fails to cure the deficiencies of disclose *Pawlyk* and *Onoe*, as mentioned above. For example, *Hiai* discloses a carrier gas introductory tube 20 located below an organic metal compound packed bed 60. See col. 3, lines

59-67 and Figs. 1-3 and 5. Therefore, *Hiai* fails to cure the deficiencies of *Pawlyk* and *Onoe*.

9. *Visser*

Concerning *Visser*, *Visser* discloses a reservoir 4 with liquid or solid substances 5 in the reservoir, which are heated with a heater element 6 provided with a temperature control unit 16. See Abstract, and col. 4, lines 24-44. However, *Visser* fails to cure the deficiencies of disclose *Pawlyk* and *Onoe*, as mentioned above. For example, *Visser* does not disclose or suggest a powder source, let alone the other features mentioned above that *Pawlyk* and *Onoe* fail to disclose or suggest. Therefore, *Visser* fails to cure the deficiencies of *Pawlyk* and *Onoe*.

10. *Sielaff*

Concerning *Sielaff*, *Sielaff* discloses a stock vessel 2 filled with a liquid 3. However, *Sielaff* fails to cure the deficiencies of disclose *Pawlyk* and *Onoe*, as mentioned above. For example, *Sielaff* does not disclose or suggest a powder source, let alone the other features mentioned above that *Pawlyk* and *Onoe* fail to disclose or suggest. Therefore, *Sielaff* fails to cure the deficiencies of *Pawlyk* and *Onoe*.

11. *Antell*

Concerning *Antell*, *Antell* discloses a dip tube 16 within a chamber 12, wherein the chamber 12 includes solid reactant sources 18 therein. See Fig. 2. However, one of ordinary skill in the art would not combine *Antell* with *Pawlyk* and *Onoe* because *Pawlyk*'s screens 15, 16 and *Onoe*'s subcontainers 30a, 30b, 30c would provide different powder source locations and would interfere with the dip tube 16 of *Antell*. Therefore, *Antell* cannot be combined with *Pawlyk* and *Onoe*.

For at least the reasons set forth above, Applicants respectfully submit that claims 1 and 25 are allowable. Claims 2-6, 10-20, 22-24 and 27-30 depend from claim 1, and claim 26 depends from claim 25, and the claims are allowable for at least the same reasons that claims 1 and 25 are allowable. Withdrawal of the rejections is respectfully requested.

3. New Claims

New claims 31-34 are added to the application. Applicants submit that the new claims are allowable over the references of record.

4. Conclusion

On the basis of the foregoing, Applicants respectfully submit that claims 1-6, 10-20 and 22-34 define patentable subject matter and should be passed to allowance. Allowance of this application is respectfully requested.

Furthermore, if the Examiner believes that a further discussion regarding this application would help advance prosecution, the Examiner is invited to contact Applicants' representative at the telephone number listed below.

It is believed that this Response requires no fee. However, if a fee is required for any reason, the Commissioner is hereby authorized to charge Deposit Account No. 02-4800 the necessary amount.

Respectfully submitted,

BUCHANAN INGERSOLL PC

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